PRODUCTION OF LOW COST FEMININE HYGIENE FROM KENAF

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ABSTRACT

Kenaf has been discovered for its potential in different kinds of industrials such as paper making, manufacturing materials, sanitary products and tissues. Kenaf is known as the most economical crop. The present exist of feminine hygiene product are produced by high cost chemicals. This may cause to increase the price. Lots of women in the developing countries still do not have enough supply of cheap feminine hygiene product and this force them use unhygienic materials such as rags, barks and even mud. So there is a need in invention and manufacturing of low cost sanitary product. This research is to analyse the best method for the production of low cost feminine hygiene from kenaf by using suitable mechanical and chemical method. Application of acidic, alkaline and hypochlorite treatment in the pulping process will increase the quality of fluff pulp without affect its basic fibre properties. The raw material of kenaf is supply by National Kenaf and Tobacco Board, Kuantan Branch. Mechanical separation was done to remove the outer bast fiber of kenaf manually. In this study, Sodium Sulphite, Glacial Acetic acid and sodium hypochlorite was used in the production of pulp as it is low cost and suitable for treating core fibres. All the samples were sent for FESEM and SEM scanning to investigate the morphological condition of the pores of the fibres for the sample. Absorbency test was carried out for each sample. The absorbency of each sample includes untreated and treated samples are higher than 1.00 g of ink/g of ink/g of sample as shown in table 1. Samples treated with 20% Glacier Acidic acid show lowest absorbency with 1.08 g of ink/g of sample. Samples treated with 1 g of sodium sulphite showed quite high absorbency at 1.836 g of ink/g of sample. The treated sodium sulphite kenaf core pores are porous and there is increasing in the absorbency characteristics. Furthermore, EDS FESEM analysis shown elementary composition contains inside samples without any sulphur remained in sodium sulphite treated sample.

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LIST OF ABBREVIATIONS

°C	Degree of Celcius
cm	Centimentres
μL	Microliters
%	Percentages

LIST OF ABBREVIATIONS

CTMP	Chemothermomechanically pulp
EDS	Energy Dispersive X-Ray Spectroscopy
FESEM	Field Emission Scanning Electron Microscopy
SAP	Superabsorbent polymer
SEM	Scanning Electron Microscopy
TMP	Thermomechanical pulp

1 INTRODUCTION

1.1 Background of Study

Kenafwith scientific name *Hibiscus cannabinus L.is belong to* Malvaceae family. *Hibiscus cannabinus* based from genus *Hibiscus.* The kenaf is mainly grown in Asia country for example Thailand, India and China. Southern parts of the United States and Mexico also have the production of kenaf, too. Kenaf fibres show similar characteristic with jute fibres, so it can be jute-like fibres (Steef et al.2008). Fibres of kenaf are one of those which have been widely researched since late 1950s. Based on FAO (2011), world production of kenaf and allied fibres cover about 290.1 kilo tonnes (FAO,2011). Kenaf in Malaysia has the potential to be famous in the production of different kinds of fibre products such as newspiece, diapers, absorption pads and more. Kenaf contain of two kind of fibre that is inner fibre and outer fibre. Usually Kenaf grow in straight, without branch, and need about 5 to 6 months to achieve maximum height. Kenaf height is about four to five meters and its diameter is around 25 to 35mm.

Nowadays in the field of non-fibre wood production, Kenaf can be referring as the most economical crop. Different researches are done for kenaf based on it fibre characteristic and absorption characteristic of kenaf core. For example, kenaf core and bast has been proved that absorption can achieve about 35 times its weight of oil. This show effectiveness of kenaf core removes oil from water surfaces (Anthony, W.S. , May 1994). Pakistan Paper Corporation (PPC) Mill, Charsada research has successfully produce newsprint from kenaf pulp. The newsprint from the kenaf chemi-thermomechanical pulp showed well in printability tests and achieves the quality of standard newsprint (Gopang,A.D.,2000). Based on the studies, the past invention of production of cellulose products from pulp to form fluff by using dry disintegration and treatment composition having good liquid absorption and it is suitable use as acquisition layer for absorbent articles (Laursen,1981;Othman A.H. 2007). Usually absorbent articles of feminine hygiene product consist of four parts that are an absorbent core, acquisition layer, top sheet and a back sheet. Top and back sheet mostly is made from textile fibre such that one side is porous while the other side is impermeable. This kind of design is to enable fluid can flow contact with absorbent core at the porous whereas prevent fluid flow out at the impermeable side. For better distribution of liquid and higher rate of liquid absorption, the acquisition layer is inserted in the absorbent article. Besides, this kind of feminine care product structure can have better surface dryness and decreased the probability of gel blocking. Usually an acquisition layer may consist of synthetic fibres and composite of cellulosic fibres. Hygiene product which made from synthetic agents can achieve high absorption rate. However some invention may use cross-linked cellulosic fibre as easy to manufacture (Othman A.H. 2007).

For production of good sanitary product, the main things are to ensure that the product can absorb liquid and retain for a range of time when a compressive load is apply. The product should not leak when absorbing and distributing the liquid. High absorption capacity is the main properties that an absorbent should have. Besides, the hygiene product which is produce need to be comfortable to wear without any harmful and irritating components (Leif, N., 1996).

1.2 History of Kenaf

This project focuses on both the CFD and experimental study of gas-liquid bioreactors, i.e. bubble column and stirred tank. Scaling-up method of stirred tank bioreactor depending on the knowledge of mass transfer, mixing and gas-liquid hydrodynamics which was Africa was the first country which started plant and used kenaf as domestic crop. In the past 200 years, India also began to involve in production and used kenaf producing twine and rope. Kenaf was produced in Russia at year 1902 and brought to India in year 1935. During World War 2, United States had done lots in kenaf research and production to supply material for war use. The war cause increasing in the use of fibre by United States and supply of fibres from countries like Philippines to be disturbed. Scientists managed to invent high-yielding antharacnose-resistant cultivars, cultural practices and cutting machinery successfully as the research was done continuously. Kenaf was being recognised as excellent fibre crop for a wide range of products including papers in the 1950s and early 1960s. In 1990s, most researches in mainly focussed on suitability of kenaf crop for production of new products such as adsorbents, textiles, building materials and so on (Charles.L.,Webber.III,Harbans L.,et al, 2002).

1.3 Basic Growth Cycle of Kenaf

Kenaf has become main fibre crops for production of different types of product as it is low cost and fast growth plant. As kenaf can achieve maximum height within 4 to 5 months, so kenaf can be harvested 3 times annually. There are more than 20 countries involve in kenaf cultivation. For example Vietnam, Iran, Russia, Taiwan and so on. China, India and Thailand possess around 95% of total production of kenaf (Yaghoob.T. et al, 2011). According to Julian C. Crane and Julian B. Acuna (1945), kenaf crop which at different growth stages has different percentage of fibre. About 1.66 to 2% of fibre is present in the kenaf which is 97 days after planting. On the other hand, there is 6.44% of fibre content in the plant collected during time of seed maturity. This shows that as the plant is actively grown the fibre yield is increasing (Julian C.C. & Julian B.A., 1945).

1.4 Current Applications of kenaf

Kenaf is a popular short day herbaceous crop which most countries harvest for its bast and core fibres. There is a big potential for kenaf to become commercial crop in Malaysia as some product has been produce and more research are done on kenaf currently. Kenaf was mainly applied in production of paper, thermoplastic, composites fabrics and absorbent. Fishing nets, sacks, ropes and doormats which made from kenaf stem fibre are good for use as high mechanical strength of fibre is being produce by specific polymer treatment. Besides that, woven produces from soft fibre can be use to produce clothes. In addition, there is cooking oil and margarine produce from kenaf. Kenaf is also important in manufacture of soap, linoleum, paints and more. Physical and chemical properties of kenaf bring lots of advantages to commercial product as well as alternatives for wood products (Department of Agriculture, Forestry and Fisheries, 2012).

1.5 Basic Economic of kenaf

Kenaf is a low cost, biodegradable and environment friendly plant which produce in large amount. Nowadays, kenaf has gain high market values as more and more commercial products is being produce based on kenaf. Less chemicals are needed for kenaf pulping as low lignin content compare to other wood. Besides, bleaching is less use for fibres and thus help in reducing of wastewater contamination. Only storage for raw material and fibre preparation need a larger investment (Ovidiu Inlius Chiparus, May 2004). Based on journal by Techno Forest Co. Ltd (May 2004), the market price for pulp had increase from US$600/Mt to US$700/Mt during year 2000. For softwood pulp, the price is raised slowly about 5 % while hardwood paper pulp price improved at 10% for last 7 to 8 years. Increasing trend of pulp market price shows there is demand for kenaf which function as an alternatives crop for production of pulp. Japan which is a high-tech country also starts import in kenaf pulp for their country paper production (Techno Forest Co., Ltd, May 2004).

1.6 Motivation

Few chemical and mechanical methods have been tested to get better production of fluff pulp since early 1970s. However most of the fluff pulp is produce by using expensive chemicals or mix with superabsorbent materials to increase the absorbency. There is a need for production of low cost fluff pulp from kenaf by using common and cheaper mild chemicals. It will be nice if the cost of fluff pulp production can more economically and low cost feminine hygiene product can be produced for millions of women it is unaffordable to buy feminine hygiene products.

1.7 Problem Statement

Based on the previous invention, most of the research is being done by using chemicals for the production. Specific chemicals use may increase or decrease the performance of the fibre and it is non-biodegradable. This kind of product may cause environmental concerns and it is expensive. Suitable chemicals must be chosen for the production of high quality feminine hygiene product and also must be low cost. The continuously increasing cost of fluff pulp bring concerns and rising the need of production of better feminine hygiene product which is cheaper, natural and environmental friendly absorbent core. This research will help production of more economical feminine hygiene product and improve the lifestyle of women in developing countries even other countries.

1.8 Objective

The objective of this research is to analyse the best method for production of low cost feminine hygiene by using suitable mechanical and chemical method.

1.9 Scope of this research

The following are the scope of this research:

i) Using grinder and blander as the machine for the mechanical method

ii) Application use of low cost chemicals in pulping process

iii) Examine the structural morphology and elementary composition by using FESEM and SEM

iv) Obtain absorbency and moisture content of fibres through analysis.

2 LITERATURE REVIEW

2.1 Overview

Kenaf usually produce in large amount as it is has high adaptation and easily grow. Kenaf has 2 layers component that is an outer periphery and another one is inner woody component. The whole stalk of kenaf is bound by lignin. The pith that is present in the kenaf core is highly absorbent material. Based on the chemical composition of the fibres, alkaline and acidic treatment is being used during the pulping process. This will help to improve the quality and performance of pulp produce.

2.2 Introduction

In Ancient Africa, kenaf has been grown for almost 4000 years. United States got a lot of kenaf plantation too. Kenaf is a type of fast growing plant and it can grow to a height about 3.5 to 4.5 metres within 5 months. According to U.S. Department of Agriculture, yield of kenaf is about 6 to 10 tons of dry fiber / acre annually. Kenaf grow best in sandy well drained soil although it got high adaptation ability (Mitul Zaveri, May 2004).

In Malaysia, kenaf fibres are produce in large amount mainly at east coast including Kelantan and Pahang. National Kenaf and Tobacco Board is one of the organisations that were established in the year 1973. The culvation of kenaf was started since 2005. Around 2010, more lands are allocated for the plantation of kenaf and some of the research and development are carry out to studies the fibres production from kenaf. National Kenaf and Tobacco Board Malaysia is also working hard on getting good quality seed and fibre production. Kenaf as natural fibres has become more popular in various industries. As there is a large possibilities commercial product from kenaf, kenaf has been identify as new industrial plant for Malaysia by National Kenaf Research and Development Program. During 9th Malaysia Plan (2006-2010), about RM 12 million of budgets are allocated to encourage the research and development of kenaf-based industry. Based on the data provide by National Kenaf And Tobacco Board about 2911 tonnes kenaf fibre was produced from 343 hectares of land at Kelantan and Terengganu in Year 2009. 50 farmers were involved in the plantation of kenaf fibre (National Kenaf and T.B, 2009). Plantation of kenaf yields approximately 6 to 10 tons of dry fibre per acre per year based on information given by the research officer from Malaysian Agricultural Research and Development Institute (MARDI). Yield of kenaf is roughly 3 to 5 times more than the yield of pine trees which require 7 to 40 years to achieve same amount as kenaf's yield. Kenaf generally gives height of 3.66m to 4.27m (12-14 feet) within 4 to 5 months because kenaf is a fast grow fibre crop (Muhammad Ridzwan.b.I, 2007).

Previously, crops such as jute, abaca, pineapple and jute are mainly applied for production of ropes, twine and burlap. Physical and chemical properties of natural fibre such as low weight, low cost, low density, biodegradable and high specific properties bring advantages to automotive and construction industries. This proves that kenaf has the potential in replacement of wood for both industrial and apparel applications. As time passed, kenaf has gradually become commercial and enlarging the field from main role as cordage crop to different new applications. New invention products make from kenaf including absorbents, paper products, livestock feed, building materials and so on. As more products are being produce from kenaf, there is an increase demand for kenaf crop. Kenaf has grown from basic agricultural production to commercial product in the market. According to previous researches, kenaf has been recognised as excellent cellulose fibre source for paper products. Besides, less energy and chemical is need for kenaf pulping process than other standard wood source. Harvesting of kenaf is being done by hand manually. A curved blade or machete is use to cut kenaf stalk near the ground level during hand-harvested. Most of the time of harvest is the time when plants were still actively growing (Charles.L. 2002).

Figure 2-1: Kenaf crop which was harvested and tied in bunches at Cherating Plantation Farm

There are two components that kenaf has is an outer periphery and another one is inner woody component. The outer periphery component with name Bast Fibre takes around 30 to 40% of the plant by weight whereas the inner woody core weighs about 60 to 70% of the plant. The whole stalk of kenaf is bound by lignin. The lignocellulosic fibre cell wall of kenaf is formed by strong semicrystalline cellulose microfibrils (Mehdi et al. 2010). These two components of kenaf can be separate by a process called retting. There are three types of retting will be done that is bacterial retting, chemical retting and mechanical retting (Mitul Zaveri, May 2004). Decorticator is used for mechanical operation for the very first process of production. However, decorticators were only design for getting bask fibre as main material and throw the unused core material. There is a number of new and advanced ribboner or decorticators are created especially for in-field harvest-separator. By this kind of new inventions, core materials can be harvest for other uses besides bark material.

Figure 2-2: Different fractions of kenaf core and kenaf pith (Steef et al.2008).

The bast fibre of the kenaf which is obtained can be cut into specific length and its density is about 1.293 + 0.006 gm/cm^3. The bast fibre can be used for production of carpet backing, canvas, sacking, door and instrument panels or high quality paper. For the core, it is hard wood material which commonly used in production of absorbent for example packing materials, animal beading, insulative and acoustic Pads and more. The refined fibres can achieve length about 0.6 mm. Density of the core is range from 0.09 to 0.11gm/cm^3. Besides, the pith that is present in the kenaf core is highly absorbent material which has absorption ability of fluid up to 20 times its own weight. The pulps that produce from kenaf is usually treat with white pigment, to get a brighter colour to pulp fibre. Colorant or fluorescent whitening agent can also be used as those chemicals are help to whiten the pulp (Amar N. N., Hugh W., David L.L., 2005).

2.3 Types of Kenaf

Kenaf can be obtained easily at tropical and subtropical areas. For example China, India, Northern Africa, Russia and even United States are joining in cultivation of kenaf. Lots of research is being done to maximise and enlarge the uses of kenaf for commercial market. It is popular as biodegradable crop which has many commercial values in market. There are different types of kenaf being cultivated for better resistant to insect pests and disease, faster growing rate and increase in quality of fibre. Even though kenaf have high growth ability at different soil types, choosing suitable location for plantation of kenaf is important as kenaf is sensitive to frost. Refers to Nasional Tobacco and Kenaf Board of Kuantan information, there are two kind of species that are plant by the farmers at kenaf plantation of Pancing and Cherating areas plantations. One is Kenaf origin from China and another one is species from Australia.

Figure 2-3: Australia type of Kenaf with cordate leaves.

Figure 2-4: China type of Kenaf with linear leaves.

2.4 Commercialise of Kenaf

A lot of research have been carried out to wider the use of kenaf as an absorbent as kenaf core comprise of high absorbency material. Kenaf core can be use in many others field for example as a poultry litter and animal bedding , as a bulking agent for sewage sludge composting, and as a potting soil amendment . There is a creation of animal bedding for livestock like horses, cattle and rodents from kenaf core material. The main reason for this creation is that the animals do not consume it. Based on the previous research, the core will absorb about 4 times its own weight of water. The most coarse fraction absorbing the largest amount of water. Manually separated kenaf pith showed 20 times its weight of water absorption. However, kenaf core must free from fibre and dust because animal bedding materials require low dust content.

Other than above core products which can be seem in the market place, few amount kenaf core products have given a big contribution in toxic waste clean-up. This toxic waste cleanup including oil spills on water, and the remediation of chemically contaminated soils. (Webber, et al, 2002) Kenaf fines are excellent sorbent materials comparable to commercial sorbent materials. Kenaf has the same absorption capacities and a higher retention capacity as polypropylene. Kenaf core performs as well as a polypropylene web does in absorption of high viscosity oil from seawater. (Monti,

2013) Natural Fibres uses kenaf core fibres as the absorbent filler in the manufacture of patented oil and chemical spill products, e.g. booms, pillows, and mats. (Kugler, 1995)

Furthermore, the entire kenaf plant, including the stalk (core and bark), and leaves, can be used as a livestock feed. Research proved that there is high protein content in kenaf. Kenaf stalk content crude protein about 2% to 12% while about 6% to 23% is whole-plant crude protein .Sheep usually feed on kenaf as a supplement in rice ration.

Besides, Kenaf is also suitable for production of paper and cardboard products. Scientists at the ARS have tested several kenaf pulping techniques, with the pulps being used to make several grades of paper including newsprint, bond, coating raw stock and surfaced sized. Results have been positive, particularly in terms of paper quality, durability, print quality and ink absorption.

Newspapers made from kenaf pulp have been shown to be brighter and better looking, with better ink lay down, reduced rub off, richer color photo reproduction and good print contrast. Quality analyses showed kenaf newsprint to have superior tear, tensile and burst ratings. Additionally, kenaf newsprint manufacturing requires less energy and chemicals for processing, an important advantage, both economically and environmentally (Webber, et al, 2002).

2.5 Chemical composition of kenaf

Cellulose, hemicelluloses, and lignin are the main component for kenaf soft wood crop. Besides there are some extractive and a bit inorganic matter content in the plants. Knowledge on the chemical properties is will lead to better understanding of the strength of plant and help in deciding pulping method for absorbent production. Lignin is a type of mechanical support of plant which exists in three-dimensionally branched network polymer. Lignin holds the fibres tightly as it act as binder for lignocellulosic plants. Different parts of plant body have different lignin concentration. There is a high concentration of lignin in the middle lamella of secondary cell wall. Lignin is the main component that needs to be removed from bundle fibres during chemical pulping lignin to separate the fibres. Cellulose refers to the homo-polysaccharide long linear chains which is main cell component in plant. Effective chemicals must be used when dealing with cellulose as the cellulose fibres arrangement is in high strength crystalline form. For hemicellulose, it helps occupies the fibre which is in white solid substances.

Hemicellulose can be easily hydrolysed to simpler form of sugars due to its low degree of polymerisation of 100 to 200. On the other hand, Organic solvent and water can be used to isolate the extractives which present in plant for example terpenes, fatty acids esters, volatile oils and others. Inorganic content of plant like ash is generally deposit in cell wall and parenchyma cells (Ahmad.A.M, et,al. 2010). The specific chemical composition for kenaf bast and core fibre is shown in Table 2-1 and 2-2.

Table 2-1: Chemical Composition of Kenaf Bast fibre (Mitul Zaveri, May 2004).

Constituents (%)	Natural	BR	CR
Cellulose	59.8	73	82.8
Hemi Cellulose	11.6	12.6	8.2
Lignin	17	5	3.6
Cell Wall Contents	10.4	7.9	4.6
Ether Soluble Extract	1.2	1.5	0.8

Table 2-2: Chemical Composition of Kenaf Core fibre (MitulZaveri, May 2004).

Constituents (%)	Natural	BR	CR
Cellulose	59.8	73	82.8
Hemi Cellulose	11.6	12.6	8.2
Lignin	17	5	3.6
Cell Wall Contents	10.4	7.9	4.6
Ether Soluble Extract	1.2	1.5	0.8

2.6 Chemical Pulping

The process of converting lignocellulosic raw materials into mass of fibre (pulp) is call as pulping. Pulping process is done before proceed to fluffing process. Acid and alkaline are used to treat the fibres at optimum temperature. The acidic and alkaline treatments are effective for degrading the lignin and other non-cellulose component in the plants (Ahmad.A.M, et,al. 2010). Furthermore, undesired substances which contain in the natural fibres can be removed through alkali treatment. Besides, the properties of the fibre-matrix interlocking and fibres will be altered by the chemical treatment using alkaline. Fine structure of fibres cellulose is affected by the alkali treatment which gives the fibres a rougher surface as compare to untreated fibre. This is because few amount of lignin and cellulose component are being removes through alkalization (Y.A.El-Shekeil, 2012). According to Mohd.S.S.et al (2011), acidic treatment that is applied on kenaf core fibres are proven increase the adsorption capacity of adsorbent effectively. Less chemical is need for kenaf process as the lignin content is low.

2.7 Fluff Pulp

There is about 2.5 million tons of fluff pulp produce from all country in the world. Only long fibres which are inside the softwood can be used for the production of fluff pulps (Olli, J. et al, 1991). Mostly the material for production of absorbent is chemical pulp, for example bleached chemical pulp and CTMP (chemothermomechanically pulp). (Leif, N., 2002). Lignin fraction in the softwoods and hardwoods will be removing by using chemical treatment to manufacture a cellulosic pulp. (Martin, G.H., 2000)Based on previous record, the production of complete bleached chemical pulps make up about 90% of the pulps produce. This kind of bleached chemical pulps usually make up of sulphate pulps. The remaining portion is for production of CTMP (chemicalthermomechanical pulps). Peroxide is use for bleaching of fluff pulp to degree in the range 70 to 80% of the brightness. Besides, fluff pulps that can be used for hygiene product include TMP (thermomechanical pulp) and groundwood, too. Fluff pulp production is different from paper pulp production in terms of drying, web formation and wet pressing process. However, all these process steps are important to ensure production of high quality product. Fluff pulp is commonly sold in rolls form which still contains moisture about 5 to 10%. Fluff pulps are the main source of absorbent layers in the hygiene product for example napkins, diapers, pads and more. There is large demand of fluff pulp for the production of air laid products. The pulp production process will determine the ratio between the knot content and energy needed (Olli, J. et al, 1991). Other than that, process of air laying of dry fibre can also be done for the wood pulp as it will help to create bulkier structure for the absorbent. This kind of bulkier structure has high absorbent capacity for liquid and cushioning properties (Robert, T.E, Dennis, C. H., 1980).

2.8 Feminine Hygiene

Feminine hygiene product is design fully for all the women in the world. Synthetic materials always become choice of producer to produce the sanitary pads as it give high absorbency and easy to produce. However, this may cause discomfort and health problems to female as time pass because the product contains lots of chemicals. Natural fibre is the best material for producing absorbent for feminine hygiene product since it does not contain any synthetic materials. Feminine hygiene product should possess the basic criteria of natural pH balances for good absorbent which would not bring irritation and yeast infection (Cannabis Cosmetics, 2012).

2.9 Absorbency

Nowadays, mostly natural absorbents that are selling in the market are originally from cellulosic fibres. Absorbency refers to the phenomena of aqueous fluids absorption by porous or fibrous materials or polymeric systems. It is relate to the swelling and partial dissolution of absorbent core. The most important quality of feminine hygiene product is absorbency. A feminine hygiene product must have high absorbency to keep sensitive area dry without leaking or cause any discomfort. Absorption is a process that one fluid diffuse through an absorbent material. Absorption generally occurs due to the capillary pressure which is applicable in fluff pulp which it fibres is scattered in random style to make a Nonwoven. Porosity of the fibres is very important in affecting the absorption capacity of product. Level of amorphous and crystalline of the materials will determine the rate of absorption of the absorbent core (Mitul Zaveri, May 2004). Larger specific surface area and higher absorption ability of a fibre are most suitable for the production of fluff pulp in absorption articles (Inger,V.E., Goran E. A, Lars, E.R.W, Feb 20, 1996).

2.10 FESEM and SEM

Field Emission Scanning Electron Microscopy (FESEM) isa scanning electron microscope which consists of field emission cathode in the electrode gun that can provide thinner probing beams. This high technology electron microscope able to give high quality of spatial resolution and reduced the risk of sample charging and destroy. Besides that, FESEM also provide high magnification for different types of sample and produces clearer image than SEM. For observation of sample surface structures, it is usually can be obtained through JEOL JSM-7800F Field Emission Scanning Electron Microscope. JEOL JSM-7800F possess of in-lens objective design which allows high resolution observation of nanostructures. In addition, JSM-7800F is design with JEOL r-filter of 2nd generation. The specimen morphology and composition can be clearly observe by adjust the filter of the secondary and backscatter electrons. Features that are being observed in the FESEM image generate can be immediately transfer for elemental composition analyse using EDS (PhotoMetrics FESEM, Retrieved on Dec 2013). For Scanning Electron Microscopy (SEM), it more focuses on scanning the surface of specimen and generates signals which will be collected by detectors to form image. The image of the scanning result is displayed on a cathode ray tube screen. The signals that are generated can be grouped into 3 types, that is secondary electrons, backscattered electrons and characteristic X-rays (PhotoMetrics SEM, Retrieved on Dec 2013).

2.11 PH considerations

The pH of a substance for liquid is refer to the measurement for the molar concentration of hydrogen ions for example test whether a solution is acidic or base type. pH of fluff pulp is an important criteria which need to be consider in the production of absorbent for feminine hygiene products. Inappropriate pH level of chemical treatment absorbent produce may cause yeast infection or mycosis as the natural of bacteria flora is affected. It is necessary to maintain the pH level of 5.5 to ensure proper intimate hygiene for women. Therefore, in order reduces the risk of bacteria overgrowth, intimate hygiene should be take care all the time (Women Web, 2004-2010).

2.12 Moisture Content

Moisture refers to the water content in a sample. Moisture content can be defined into two basics that are wet and dry. The amount of water per unit mass of dry sample is the dry basic of moisture content. On the other hand, the wet basis moisture content can be defined as amount of water present per unit mass of wet sample. Moisture content of the kenaf plant at harvest is usually at 75%. Moisture content of the growing plant may affect the harvesting and processing system of kenaf. Kenaf plant which has higher moisture brings ease to cutting process.

2.13 Previous Work on Natural Fibre on Fluff and Pulp Production

From previous invention, it is known that non-ionic fatty acid esters can mix with cationic retention agents to produce cellulose pulp with better disintegration. After dry-defibration, the fluff showed quick liquid absorption property. Even though cationic surface-active agents for example quaternary ammonium compounds are use to weaken the bonds between the cellulose fibres, it may cause increase in water absorption time as it consist of longer fatty acid chains. However this kind of application may cause bad effect on the hydrophilic properties of product manufacture. (Oscar, W. M., Philip M.H., 1984) Besides, that compounds may cause corrosion damage on equipment and decrease the brightness of the fluff as the present of chloride ion as anion (Laursen, 1981).

An innovation for production of fluff pulp for absorption products by using mineral type of micro particle like bentonite and additional inorganic particle compound of synthetic silicate compound has been reported. The fluff pulp which produces has low knot content after defibering process is carried out. Bentonite is usually used in the retention agent system with particles size range from 2.5 to 100nm. Addition of bentonite is done to wet pulp stock at a fixed and optimum pH (Annica S., Stefan, Helena, 2005).

According to United States Patent US 7,312,297 B2, treatment composition can be one of the method use for fluff pulp production in sheet form. For treatment composition, it involves mixture of cross-linking chemical and anti-hydrogen-bonding agent. Fibres produce by cross-linking is aimed for better physical and chemical properties of fibres as it improving shrinkage resistance, reducing wrinkling and increase fluid absorbency. Although cross-linking agent can help to improve some fibres properties, there is some difficulties relating to defiberize fibres cross-linked in sheet form. The method of using cross-linked is not very suitable for production fluff pulp in sheet form as it the process cause decrease in fibres performance and involve higher cost (Othman A.H., Dec 2007).

The advance of superabsorbent agents also being introduce into production of absorbent material as it can reduce the use of fluff pulp. Superabsorbent materials or polymers (SAP) have greatly improved the fluid retention characteristic of absorbent core. The absorbent core which is produce by using SAP can absorb up to 100 times their weight. However the superabsorbent polymers are relatively higher cost compare to other natural materials (Mitul Zaveri, May 2004).

Besides that, application of enzyme treatment in the production of fluff pulp is also being invented based on US Patent 5,068,009 (1991). The invention won't cause any main properties of fluff pulp being affected. It may increase the quality of fluff pulp as the knot content is decrease and reduce the usage of energy when shredding process is